Small Grain Production in Southwest Iowa

Nathan Mueller
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Introduction

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Overview

• Needs assessment by growers

• Wheat production in the region

• Economics and weather

• Soil health aspect

• Winter wheat management for new growers:
  • Variety Selection
  • Diseases
  • Planting dates and rates
  • Nutrients
Needs Assessment
Needs Assessment

1. Variety trials
   1. Added location in 2017
   2. More changes this fall

2. Wheat in rotation research
   1. On-farm research studies through NRCS Soil Health Demonstration Farms

3. Soil fertility research and recommendations
   1. Nitrogen and sulfur fertility trials

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Winter Wheat Production Needs Assessment in Eastern Nebraska

Eastern Nebraska grower (n=37) and UNL and NRCS faculty/staff in responses (n=7) conducted in 2015 and 2019.

- Continue variety trials for eastern Nebraska
  - No-till after soybeans and seed corn
- Wheat in a corn/soybean rotation research
  - Research to document the impact wheat in rotation with corn and soybeans has on reducing soil erosion
  - Research to document the economic and rotation benefits and profitability to adding wheat to the corn/soybean rotation such as those below:
    - Rainfed corn-soybean-wheat/cover crop (3 crops in 3 years)
    - Rainfed corn-soybean-wheat/forage crop (4 crops in 3 years)
    - Irrigated corn-soybean-wheat/double-crop soybean (4 crops in 3 years)
      - Has this changed with climate change/growing season length?
      - BMPs for system and modeling to assess risk of not reaching maturity
      - Irrigated seed corn or short season corn-wheat-double crop soybeans (3 crops in 2 years)
- Soil fertility research and current fertility programs
  - Evaluate the need for chloride and sulfur applications in various soils
- Row spacing and seeding rate
  - Diseases risk and yield
- Predicting lodging risk and mitigation
  - Palisade (growth regulator), variety, N rate
- Cover crops after wheat research
  - Species, mix, management, etc. to benefit the next crops and economics
- On-farm storage BMPs and marketing considerations/plans for both grain and straw
- Managing winter wheat for cover crop seed production
- Crop rotation considerations
  - Cover crop after wheat for grazing or nitrogen credit
    - Mix versus mono-legume
    - Soil type consideration for cover crop
  - Corn, soybeans or other crops following year after wheat
  - After seed corn versus after soybeans
  - Shorter season corn and soybeans, potential yield penalty
- High yield practices
  - Plant population/stand counts
- Fungicide application methods and volume
Wheat Production in the Region
U.S. Wheat Production and Classes

The map above illustrates the distribution of wheat production across the United States, highlighting various classes of wheat:

- **HARD RED WINTER**
- **HARD RED SPRING**
- **SOFT RED WINTER**
- **SOFT WHITE**
- **HARD WHITE**
- **DURUM**

The dots represent the locations where these classes of wheat are produced, with the density of dots indicating the concentration of production in each region. The map provides a visual representation of the geographical distribution and prevalence of different wheat classes in the U.S.
CropScape Wheat Frequency – MODIS

[Map of Missouri showing crop frequency by county with a legend indicating different colors for zero to eleven years of wheat frequency.]
Retreat of Wheat in the East
Soil Moisture Regime - NRCS
Economics to Consider
USDA-NASS
Winter Wheat Yield Trends

Winter Wheat Yields for Crop Reporting Districts

Year
Northeast NE
East Central NE
Southeast NE
Local Success Stories

- Growing 100 bushel/acre wheat not uncommon
  - Thurston, Washington, and Jefferson counties

- UNL Variety Trials – Washington County
  - 2019 = 123 bpa (Plot average = 106)
  - 2018 = 110 bpa (Plot average = 99)
  - 2017 = 140 bpa (Plot average = 111)
Markets

- Grain - Strong Local Basis
  - Scoular Fremont = +0.30
  - ADM Lincoln = +0.30

- Straw – Rock Valley Hay Auction
  - Large Rounds - $70 to $135 per ton
  - Going rate in my areas was $100 per ton

150 mile radius from Fremont
Corn Yields in w/Wheat in Rotation

Monmouth 1998-2014

<table>
<thead>
<tr>
<th>Crop sequence</th>
<th>Cont corn</th>
<th>Soy-corn</th>
<th>Soy-wheat-corn</th>
<th>Wheat-soy-corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn yield, bu/acre</td>
<td>166</td>
<td>198*</td>
<td>210*</td>
<td>206</td>
</tr>
<tr>
<td></td>
<td>148</td>
<td>193</td>
<td>202</td>
<td>203</td>
</tr>
</tbody>
</table>

* indicates significantly different from tilled treatment.

http://web.extension.illinois.edu/nwiardc/downloads/58547.pdf
Soybean Yields w/Wheat in Rotation

Monmouth 1998-2014

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Tilled</th>
<th>No-till</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont. soy</td>
<td>56.3</td>
<td>57.3</td>
</tr>
<tr>
<td>Corn-soy</td>
<td>62.5</td>
<td>62.1</td>
</tr>
<tr>
<td>Wheat-corn-soy</td>
<td>66.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Corn-wheat-soy</td>
<td>67.9</td>
<td>66.6</td>
</tr>
</tbody>
</table>

http://web.extension.illinois.edu/nwiardc/downloads/58547.pdf
Winter Wheat Can Help

- Manure management flexibility
- Consider all potential profits streams
  - Value of straw
  - Double crop and forages crop options
  - Potential nitrogen credit for legume cover crop
  - Corn and soybean yield improvement in 3-yr rotation
  - EQIP and CSP opportunities
- Weed control & herbicide cost
  - Marestail, Palmer Amaranth, & Waterhemp
- Soil health and conservation
  - Soil structure, erosion control, cost-share and priority
- Workload management
- Manage weather risks
Managing Risks from Extreme Weather

Seasonal crop water use (ET) in Eastern Nebraska when water is not limiting.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Inches/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>21-24</td>
</tr>
<tr>
<td>Soybean</td>
<td>20-22</td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>16-18</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>31-35</td>
</tr>
</tbody>
</table>

Source: water.unl.edu

Source: Crop Water Use Curves from Colorado State University [http://extension.colostate.edu/topic-areas/agriculture/limited-irrigation-managementprinciples-and-practices-4-720/](http://extension.colostate.edu/topic-areas/agriculture/limited-irrigation-managementprinciples-and-practices-4-720/)
Precipitation Trends: Southeast NE
Precipitation Trends: Southeast NE
Wheat, Your Underground Partner
Crop rotation and tillage matter
Improving Soil Health with Winter Wheat

- Aspects of soil health
  - Physical
  - Biological
  - Chemical

Current issue
Soil health (biological, physical, and chemical) has been a popular focus over the past decade with emphasis on utilizing no-till and cover crops in eastern Nebraska. However, a more diverse crop rotation is often left out of the discussion as a way to improve soil health. The corn-soybean rotation is the most widely utilized cropping systems in eastern Nebraska. Despite the potential benefits adding a third or fourth crop to this rotation to improve soil health, few farmers in eastern Nebraska have because of various adoption barriers.

Crop rotation research
Two long-term (14 & 15 years) crop rotation studies in the Midwest have shown that including winter wheat into the corn-soybean rotation results in the following improvement in soil health:

1. Increase in water stable aggregates (most sensitive and best single indicator of soil physical health)
2. Higher total nitrogen
3. Higher potentially mineralizable nitrogen

These aspects of soil health were increased by adding wheat into the rotation regardless of the tillage system, conventional and no-till. The dense fibrous root system of wheat and nitrogen derived from wheat root deposits is likely the cause of these measurable differences. These long-term crop rotations studies did not include cover crops.

Overcome barriers to adding wheat
Barriers producers share
- Economies of wheat grain yield only/input cost compared to corn and soybean production
- Logistics of planting and harvesting only 1 or 2 fields
- Concerns about the learning curve of growing a new crop

Overcoming these barriers
- Improve economics by capturing good basis in Fremont, selling straw, growing forage crop after wheat, higher soybean yield in rotation, and USDA programs
- Improve logistics with custom drilling and harvesting and business opportunity
- Reduce learning curve through new website, grower group email list, and future peer-learning group, and work with cropping systems extension educators

Local Grower quotes
“It (wheat) breaks up our corn-bean rotation and it creates more organic matter, because of the root mass.” Local Farmer – Fremont Tribune

“Winter wheat gives you an additional 45 to 60 days for the cover crop to grow, which results in more material to graze if you choose to, and more root mass to help build organic matter in the soil.” Local Farmer – Nebraska Farmer Magazine

“I’m hoping the wheat residue will disperse as a mat for the soil and a cover crop to help suppress weeds as well. It might decrease some chemical costs.” Local Farmer – Nebraska Farmer Magazine

For more information
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Wheat resources for eastern Nebraska at croptechcafe.org/winterwheat

Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the United States Department of Agriculture, and abides with the nondiscrimination policies of both institutions.
Management Factors of Winter Wheat in Eastern Nebraska

<table>
<thead>
<tr>
<th>Rank</th>
<th>Management Factor</th>
<th>Yield Difference (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Variety Selection</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>Foliar Fungicide</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Row Spacing, 15 vs 7.5”</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Planting Date (2 wks)</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Nutrient Mgmt (30 lbs N)</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Seeding Rate</td>
<td>5</td>
</tr>
</tbody>
</table>
## Variety Selection is Critical

<table>
<thead>
<tr>
<th>Variety</th>
<th>3-year yield average (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB4303</td>
<td>99</td>
</tr>
<tr>
<td>AM Eastwood</td>
<td>78</td>
</tr>
</tbody>
</table>

UNL Variety Trial Test Results  
[http://cropwatch.unl.edu/winter-wheat-variety-test-results](http://cropwatch.unl.edu/winter-wheat-variety-test-results)

Colorado Wheat Variety Database  

Courtesy of Laura Thompson, UNL
Variety Testing Locations – Eastern Nebraska

- Soils and practices
  - Washington
    - Moody/Marshall series
    - No-till after soybeans
  - Saunders
    - Filbert - very deep, somewhat poorly drained, very slowly permeable soils formed in loess
    - Tilled after oats
  - Lancaster
    - Crete - very deep, moderately well drained soils formed in loess
    - Tilled after oats
Wheat Seed Brands in Eastern Nebraska

- Husker Genetics (UNL)
- NuPride (UNL)
- Kansas Wheat Alliance (KSU)
- WestBred (Bayer)
- Limagrain Cereal Seeds
- AgriMaxx
- AgriPro (Syngenta)
- Dyna-Gro

Example: Zenda – Kansas Wheat Alliance Released 2016

Placement
• All counties

Highlights
• Great yield performance record in UNL 3-yr trials
• Moderate resistance to Fusarium Head Blight
• Excellent test weight

Management Suggestions
• Replacement for Everest
• Average drought tolerance

View at croptechcafe.org/winterwheat
Disease Management
Bacterial Leaf Streak/Black Chaff

- **Disease**
  - Caused by bacteria *Xanthomonas translucens* pv. *undulosa*
  - Overwinters in residue/soil

- **Management**
  - Pathogen free seed
  - Variety selection that are less susceptible (i.e. SY Wolf, Overland)
Fusarium Head Blight (Scab)

- **Disease**
  - Caused by fungus *Fusarium graminearum & boothii*
  - Reported in NE since 1898
  - Survives on residue, in soil
  - Rainfall/humidity during flowering
  - Vomitoxin (DON)

- **Management**
  - Crop rotation (C-S-A)
  - Variety selection for resistance
  - Disease risk mapping
  - Scouting
  - Foliar fungicide at early flowering
Fungicides for FHB

- Prosaro 421 SC (Bayer)
  - Prothioconazole (3, Triazole)
  - Tebuconazole (3)

- Caramba (BASF)
  - Metconazole (3)

- Miravis Ace (Syngenta)
  - Two modes of action
    - Propiconazole (3)
    - Pydiflumetofen (7, SDHI)
Varieties with Moderate Resistance for FHB

- Varieties in the Trials
  - WB4699 (3)
  - Overland (3)
  - SY Benefit (4)
  - Zenda (5)
  - WB4269 (5)
  - LCS Valiant (2019)
Leaf Rust

- **Disease**
  - Caused by fungus *Puccinia triticina*
  - Does not overwinter
  - Central and eastern Nebraska
  - Yield losses up to 14% typical

- **Management**
  - Variety selection for resistance
  - Scouting
  - Foliar fungicide
Stripe Rust

- Disease
  - Caused by fungus *Puccinia striiformis* f. sp. *Tritica*
  - Does not overwinter
  - Has become a significant disease since 2010 in Nebraska
  - Yield loss up to 40%

- Management
  - Variety selection for resistance
  - Scouting
  - Foliar fungicide
Foliar Fungicide at Flag Leaf

Saunders County: Variety Millennium with Quilt

<table>
<thead>
<tr>
<th>Year</th>
<th>Control</th>
<th>Foliar Fungicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>15 bu/ac</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>27 bu/ac</td>
</tr>
</tbody>
</table>

Foliar Fungicide at Flag Leaf

Lancaster County: Average across 6 varieties

Planting Date and Seeding Rate
Nebraska East District for 2006-2017

Wheat Yield vs. Soybean Harvest Progress

y = 0.289x + 30.333
R² = 0.4926
Planting Dates – Eastern Districts

- Recommended
  - Sept. 25 to Oct. 15

- Crop Insurance
  - 100% coverage until Oct. 10 or 15

- Late planting
  - Until Oct. 25 or 30
Target Planting Date Map

Target planting dates

- Planting date allows for 400 GDU (Base 40) accumulation between planting and December 31
- 1980s work in southeast NE
- Temperature norms – 1981-2010 used
Planting Dates - Iowa

Wheat - Winter

Commodity - 11

1 - Yield Protection
2 - Revenue Protection
3 - Rev Protect w/ Harvest Exclusion

Saint Paul Region
2018 Final Plant Dates

Federal Crop Insurance

Planted acreage in a "No Program" county may be insurable by written agreement.

USDA Risk Management Agency
Map Creation Date: February 14, 2018
Map Projection: Web Mercator
RMA Business Analytics Division
Use Certified Seed

How to Read a Certified Analysis Tag

- **PVP STATEMENT**: This variety may only be sold as certified seed. Any other transfer or sale of this seed is prohibited by federal law.
- **CERTIFIED SEED TAG**: The blue certified tags assure the buyer is getting quality certified seed.
- **GERMINATION**: The percentage of pure seed that will germinate in a controlled lab environment.
- **LOT NUMBER**: Each lot of seed has a unique number that appears on all documents so that it can be traced back to the field where it was grown.
- **BRAND NAME**:
- **VARIETY NAME**:
- **PURE SEED**: The percentage of weight of seed that is the named species.
- **CROP SEED**: The percentage of weight that is other than the named species not considered weeds. Crop seed must be listed by name if over 5 percent.
- **INERT MATTER**: The percentage by weight of material that will not grow.
- **WEED SEED**: The percentage of weed seeds in this lot.
- **NOXIOUS WEEDS**: The amount of seeds of weeds prohibited by state law.
- **TEST DATE**: The month and year this lot was lab tested.
- **TOTAL VIABLE**: Germination percentage plus the hard or dormant seed.
- **ORIGIN**: Origin is the state where the seed was grown.
- **LOT #:** W0-428
- **ORIGIN #:** NE
- **WEIGHT OF CONTAINER:** 12156 SEEDS/LB
- **NET WT:** LBS
Seeding Rate

Lancaster County, planted Oct. 2, 2013

Bhatta et al., 2017. Seeding rate, genotype, and top-dressed nitrogen effect on yield and agronomic characteristics of winter wheat. Crop Sci. 57:951-963
Planting Date by Seeding Rate

Figure 2. Irrigated wheat yields from 2017 for a study conducted in northwest Kansas evaluating planting dates and seeding rates.

Source: https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=2004
Seeding Rate and Planting Date

Crop Tech Cafe Winter Wheat Seeding Rate Calculator for East Central Nebraska

<table>
<thead>
<tr>
<th>Estimated Planting Dates</th>
<th>Oct. 7 - Oct. 14</th>
<th>Select estimated planting dates from drop-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended Seeding Rate (Pure Live Seeds per Acre)</td>
<td>1,350,000</td>
<td>Based on estimated planting dates selected</td>
</tr>
<tr>
<td>Germination (%)</td>
<td>95</td>
<td>Enter germination from seed tag</td>
</tr>
<tr>
<td>Purity (%)</td>
<td>99</td>
<td>Enter purity from seed tag</td>
</tr>
<tr>
<td>Seed Size (seeds/lbs)</td>
<td>15,000</td>
<td>Enter seed size from seed tag</td>
</tr>
</tbody>
</table>

Contact Nathan Mueller at nathan.mueller@unl.edu with questions

<table>
<thead>
<tr>
<th>Seeding Rate (lbs/acre)</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeding Rate (bu/acre)</td>
<td>1.6</td>
</tr>
</tbody>
</table>

- Plant certified fungicide-treated seed to control seed-transmitted and soilborne fungal diseases
- Plant at 1.5 inches deep no-till after soybeans

Download at croptechcafe.org/winterwheat
Evaluating Winter Wheat Stands

- Better option than a tape measure
- No need to glue together, so easy storage.
- Interpretations
  - Assesses yield components
  - Risk of weed pressure

Current issue
Recommended seeding rates start at 1.2 million seeds per acre and increase as planting is delayed through October in eastern Nebraska. You can download the seeding rate Excel tool at croptechcafe.org/winterwheat
Evaluating your winter wheat stand and determining how many plants you have on a per acre basis is something most growers find difficult and time consuming. It is normal to use a tape measure to help count plants for corn and soybean, but not as ideal for wheat. Knowing what percentage of your seeding rate became established as plants is critical information to have to make future planting adjustments and also to make a determination, when stands are poor, to use the wheat as a cover crop.

Making your own grid for 1/10,000 of an acre
Supplies:
- One 10 ft piece of ½ inch PVC & Four PVC elbows for ½ inch pipe
- Measuring tape, saw, & permanent marker

Cut and Assemble: Dimensions to cut pipe for each row spacing:
- 7.5 inch row spacing
  - 22.5” wide and 28” long
- 8 inch row spacing
  - 24” wide and 26” long
- 10 inch row spacing
  - 30” wide and 21” long

Mark: With your permanent marker, add 3 lines (7.5, 8, or 10) inches apart to represent rows on each two sides (the side that is 22.5, 24, or 30” wide).

Assess your winter wheat stand
Count the number of plants for the three rows inside the grid in the fall or early spring with a tally counter (shown in picture) in several different areas of the field and then average those values. Interpretation of your counts from 1/10,000 of an acre grid:
- Less than 50 plants – Likely due to high variability in the stand, consider replanting at an angle or using as a cover crop
- 50 to 65 plants – Reduced yield, can still yield well with good tillering and weed control
- 65 to 95 plants – Good, can obtain close to max yield potential
- More than 95 plants – Ideal

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Wheat resources for eastern Nebraska at croptechcafe.org/winterwheat
Nutrient Management

N  P  K  S  Ca  Mg

Fe  Mn  Cu  Zn  B  Cl  Mo  Ni
Nitrogen Management

- Based on regional UNL recommendations and local grower experiences
  - 80 – 110 lbs N/acre
- Apply most or all as wheat begins to green up in February/March
- Grain protein can be improved with late N applications
  - N at Flag leaf can still improved protein/yield
Phosphorus Management

- Higher soil test phosphorus needed compared to corn and soybeans
  - Similar to alfalfa and corn-after-corn
    - 25 ppm Bray P1 or more
- Helps with early growth, tillering, and winter hardiness
Sulfur Management

- Becoming more common in northeast and north central KS and southeast NE

- No-till, cold springs, low organic matter eroded areas

- Pale yellow color in the spring, entire plant, more so on younger leaves

- 10 to 20 lbs S/acre

- Dry ammonium sulfate or liquid ammonia thiosulfate

Photo by Stephen Wegulo, UNL
Chloride Management

- Recent analysis in Kansas performed across multiple years and locations suggest an average yield response of 8% to chloride fertilization.

- Chloride has been shown to suppress take-all root rot, tan spot, stripe rust, leaf rust, and Septoria.

- Research has shown equal performance to both preplant and topdress applications.

<table>
<thead>
<tr>
<th>Category</th>
<th>Soil Chloride*</th>
<th>Cl Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb/a ppm</td>
<td>lb/a</td>
</tr>
<tr>
<td>Low</td>
<td>&lt; 30 &lt; 4</td>
<td>20</td>
</tr>
<tr>
<td>Medium</td>
<td>30-45 4-6</td>
<td>10</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 45 &gt; 6</td>
<td>0</td>
</tr>
</tbody>
</table>

*Interpretations valid for 0-24 inch samples on wheat, corn and grain sorghum.*
Resources
Welcome to the Winter Wheat Cafe for Eastern Nebraska

Positioning your farm to manage manure, control tough weeds, and improve soil health are just some of the advantages to growing winter wheat in Eastern Nebraska. Current livestock producers and future poultry growers will find additional value of adding winter wheat to their farming operation.

Resources found on this page:

View at croptechcafe.org/winterwheat
Hard Copy Resources

**Visual Guide**
Winter Wheat

**Development and Growth Staging**

**Feekes Scale** for cereal growth stages

- **Seedling Growth**
  1. One shoot, first leaf through coleoptile

- **Tillering**
  2. Tillering begins; main shoot and one tiller
  3. Tillers formed; leaves often twisted (in some varieties, plant may be prostrate in appearance)
  4. Leaf sheaths lengthen; beginning pseudostem erection
  5. Leaf sheaths fully elongated to form strongly erect pseudostem

- **Stem Extension**
  6. First node of stem visible at base of shoot; jointing
  7. Second node of stem formed; next-to-last leaf just visible
  8. Flag leaf visible but still rolled up
  9. Ligule of flag leaf just visible
  10. Flag leaf sheath completely grown out; booting

- **Heading**
  10.1. First awns of head just visible
  10.2. 1/4 of heading process complete
  10.3. 1/2 of heading process complete
  10.4. 3/4 of heading process complete
  10.5. All heads out of sheath

- **Filling**
  10.5.1. Beginning of flowering
  10.5.2. Flowering complete to top of head
  10.5.3. Flowering complete at base of head
  10.5.4. Flowering complete; kernel watery ripe

- **Ripening**
  11.1. Kernel milky ripe; milk stage
  11.2. Kernel mealy ripe; soft but dry consistency; soft dough stage
  11.3. Kernel hard; difficult to divide with thumbnail; hard dough stage
  11.4. Kernel harvest ready; straw dead
Thank You!